

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
19 July 2001 (19.07.2001)

PCT

(10) International Publication Number  
WO 01/51627 A3

(51) International Patent Classification<sup>7</sup>: C12N 15/82, 15/29, A01H 5/10

(74) Agents: MARSH, David, R. et al.; Arnold & Porter. 555 12th Street, N.W., Washington, DC 20004-1206 (US).

(21) International Application Number: PCT/US01/00552

(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

(22) International Filing Date: 5 January 2001 (05.01.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
60/174,880 7 January 2000 (07.01.2000) US

(71) Applicant: MONSANTO TECHNOLOGY LLC.  
[US/US]: 800 N. Lindbergh Boulevard, St. Louis, MO 63167 (US).

(72) Inventors: HAUGE, Brian, M.; 17 Clifton Avenue, Beverly, MA 01915 (US). WANG, Ming, Li; 312 Lowell Street, Lexington, MA 02420 (US). PARSONS, Jeremy, D.; 37 Walpole Road, Cambridge CB1 3TH (GB). PARNELL, Laurence, D.; 9 Eustis Street #2L, Cambridge, MA 02140-2226 (US).

(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

*[Continued on next page]*

(54) Title: SOYBEAN CYST NEMATODE (SCN) RESISTANCE LOCI RHG1 AND RHG4

rhg1 LRR

consensus LRR	L	F	S	N	L	P	N	L	E	E	L	D	L	S	N	N	L	T	S	L	P	P	G
	a	x	x	a	x		x	L	x	x	L	x	x	N			L		I				
LRR 177-200	T	L	G	L	L	P	G	L	R	K	L	S	L	H	D	N	Q	I	G	G	S	I	P
LRR 201-224	S	L	G	F	C	P	N	L	R	G	V	Q	L	F	N	N	R	L	T	G	S	I	P
LRR 225-248		L	A	N	S	T	L	L	Q	S	L	D	L	S	N	N	L	L	T	G	A	I	P
LRR 249-272	L	T	H	S	F		K	L	Y	W	L	N	L	S	F	N	S	F	S	G	P	L	P
LRR 273-297	W	G	G	N	S	K	S	L	T	F	L	S	L	Q	N	N	N	L	S	G	S	L	P
LRR 302-325	L	G	S	L	R		R	L	Q	N	L	I	L	D	H	N	F	F	T	G	D	V	P
LRR 326-349	I	G	T	L	S		E	L	N	E	L	S	L	S	H	N	K	F	S	G	A	I	P
LRR 350-373	T	L	S	N	L	S	R	L	K	T	L	D	I	S	N	N	A	L	N	G	N	L	P
LRR 374-397	S	L	G	R	L	R	S	L	T	L	N	A	E	N	N	L	L	L	D	N	Q	I	P
LRR 398-421	S	I	A	N	I	S	N	L	S	V	L	I	L	S	R	N	Q	F	S	G	H	I	P
LRR 422-445	S	F	D	S	Q	R	S	L	R	Q	L	D	L	S	L	N	N	F	S	G	E	I	P
LLR 446-470	L	L	A	K	F	N	S	L	N	L	F	N	V	S	N	S	N	L	S	G	S	V	P

(57) Abstract: The present invention is in the field of soybean genetics. More specifically, the invention relates to nucleic acid molecules from regions of the soybean genome, which are associated with soybean cyst nematode resistance. The invention also relates to proteins encoded by such nucleic acid molecules as well as antibodies capable of recognizing these proteins. The invention also relates to nucleic acid markers from regions of the soybean genome, which are associated with soybean cyst nematode resistance. Moreover, the invention relates to uses of such molecules, including, transforming soybean cyst nematode resistant soybean with constructs containing nucleic acid molecules from regions of the soybean genome, which are associated with soybean cyst nematode resistance. Furthermore, the invention relates to the use of such molecules in a plant breeding program.

WO 01/51627 A3



**(88) Date of publication of the international search report:**

20 June 2002

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

## INTERNATIONAL SEARCH REPORT

International	Application No
PCT/US 01/00552	

A. CLASSIFICATION OF SUBJECT MATTER		
IPC 7	C12N15/82	C12N15/29
A01H5/10		

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
--------------------

Minimum documentation searched (classification system followed by classification symbols)

IPC 7	C12N	A01H
-------	------	------

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, BIOSIS

C. DOCUMENTS CONSIDERED TO BE RELEVANT
--

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 95 20669 A (PIONEER HI BRED INT) 3 August 1995 (1995-08-03) claims 1,8-10,12-14; figure 1 ---	1-10, 19-28
X	PRABHU R.R. ET AL.: "Selecting soybean cultivars for dual resistance to soybean cyst nematode and sudden death syndrome using two DNA markers". CROP SCIENCE, vol. 39, no. 4, July 1999 (1999-07), pages 982-987, XP000926615 page 982, column 2, line 11 -page 983, column 1, line 21 --- -/-	1-10, 19-28

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

\* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

30 August 2001

Date of mailing of the international search report

29.11.01

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2340, Tx. 31 651 epo nl.  
Fax: (+31-70) 340-3015

Authorized officer

Schönwasser, D

## INTERNATIONAL SEARCH REPORT

International	ication No
PCT/US 01/00552	

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CONCIBIDO V. C. ET AL.: "Targeted comparative genome analysis and qualitative mapping of a major partial-resistance gene to the soybean cyst nematode" THEORETICAL AND APPLIED GENETICS, vol. 93, 1996, pages 234-241, XP000926536 page 235, column 1, line 15 - line 34; figure 3 ---	1-10; 19-28
X	CONCIBIDO V. C. ET AL.: "A common soybean cyst nematode resistance gene" PHYTOPATHOLOGY, vol. 85, no. 10, 1995, page 1140 XP001012556 the whole document ---	1-10, 19-28
A	DONG K. ET AL.: "Genetics of Soybean-Heterodera glycines Interactions" JOURNAL OF NEMATOLOGY, vol. 29, no. 4, 1997, pages 509-522, XP001014198 the whole document -----	1-28,55, 56,59, 61-65,71

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US 01/00552

### Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.: because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claims Nos.: 1-54 because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:  
see FURTHER INFORMATION sheet PCT/ISA/210
  
3.  Claims Nos.: because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

### Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1.  As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
  
2.  As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
  
3.  As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
  
4.  No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-28, 55, 56, 59, 61-65, 71

#### Remark on Protest

- The additional search fees were accompanied by the applicant's protest.
- No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box I.2

Claims Nos.: 1-54

In view of the large number and also the wording of the claims presently on file, which render it difficult, if not impossible, to determine the matter for which protection is sought, the present application fails to comply with the clarity and conciseness requirements of Article 6 PCT (see also Rule 6.1(a) PCT) to such an extent that a meaningful search is impossible. Consequently, the search has been carried out for those parts of the application which do appear to be clear (and concise), namely the cloning of rhg1 and rhg4 as disclosed in the examples, the nucleic acid molecules and proteins of claims 55-60 and their use in plants and seeds as well as methods for the production of a soybean plant, methods for investigating rhg1 and rhg4 haplotypes and methods for introgressing SCN resistance into soybean plants involving said sequences.

The applicant's attention is drawn to the fact that claims, or parts of claims, relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-28,55,56,59,61-65,71

Methods for the production of a soybean plant, methods for investigating an rhg1 haplotype and methods for introgressing SCN resistance into soybean plants, which all involve rhg1 nucleic acid molecules or proteins and their use in plants and seeds.

2. Claims: 29-54,57,58,60,66-70,72

Methods for the production of a soybean plant, methods for investigating an rhg4 haplotype and methods for introgressing SCN resistance into soybean plants, which all involve rhg1 nucleic acid molecules or proteins and their use in plants and seeds.

## INTERNATIONAL SEARCH REPORT

Information on patent family members

International. **ication No****PCT/US 01/00552**

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
WO 9520669	A 03-08-1995	US 5491081 A	AU 1909395 A	13-02-1996
		BR 9506585 A	WO 9520669 A2	15-08-1995
		US 6162967 A		23-09-1997
				03-08-1995
				19-12-2000